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(54) Title of the Invention: Character Discriminating And Coding Method

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SPECIFICATION

1. Title of the Invention

Character Discriminating And Coding Method

2. Claim

A character discriminating and coding method, comprising: detecting a character portion and a line drawing portion from a color image in which images such as a full color image, a gray scale image, etc., and white, black, and color characters and line drawings coexist; discriminating character and line drawing portion areas; discriminating an image including only characters and line drawings from an image in which characters, line drawings, etc. exist on a full color image, a gray scale image, etc.; replacing the character and line drawing portions in the image with

surrounding and average image values; generating images by removing characters and line drawings; and performing a coding process on these images.

3. Detailed Description of the Invention

[Field of the Invention]

The present invention relates to a character discriminating and coding method used for a color facsimile, etc. to efficiently transmit or accumulate an image in which a color image, a document, etc. coexist.

[Prior Art]

Conventionally, a method for transmitting information without compressing the information by coding has been devised for a color facsimile. However, the study of coding a full color image has been recently developed by CCITT, ISO, etc., and an ADCT coding method (adaptive discrete cosine transform coding) is being used.

[Problem to be Solved by the Invention]

The ADCT coding provides high efficiency and quality for a gray scale image, but has the disadvantage that sufficient compression efficiency cannot be obtained for a character portion, etc. containing many components of a high spatial frequency.

There is an MMR for G4, etc. as a coding method for a character portion, etc., but it cannot encode a full color image, etc. There is also a method being developed to encode both image and character portions in one coding method, but has not obtained a successful effect on each image.

On the other hand, a mixed mode terminal has been developed as a device for transmitting data by discriminating a character portion from an image portion, but it combines a character input by character code with an image on the receiving side, and has no function of discriminating character and gray scale portions from a raster image on the input side.

This present invention has been developed to solve the above-mentioned problems, and an object of the invention is to provide a character discriminating and coding method for efficiently encoding a document in which a color image, a document, etc. coexist, specifically a document containing a character, a line drawing, etc. on a gray scale color image between a character portion and a gray scale portion, and transmitting resultant data.

[Means for Solving the Problems]

The character discriminating and coding method according to the present invention detects a character portion and a line drawing portion from a color image

in which images such as a full color image, a gray scale image, etc., and white, black, and color characters and line drawings coexist; discriminates portions only including characters and line drawings; replaces character and line drawing portions extracted in the discriminating process on the image in which characters and line drawings exist on a full color image with surrounding and average image values; thus generates images by removing characters; and performs a coding process on these images.

[Operation]

The invention discriminates between a character portion and a gray scale portion in a document in which a full color image, etc., characters, line drawing, etc. including a document, etc. in which characters and line drawings are arranged on a gray scale color image, and efficiently performing coding and electrically transmitting data.

[Embodiments]

Figure 1 shows an embodiment of the present invention, and Figures 2 to 4 are explanatory views showing the invention.

Figure 1 shows an original read unit 11, a memory unit 12 for temporarily storing a read image, an area identification and discrimination unit 13 for

identifying and discriminating a color area in an original, a coding unit 14, a binary image coding unit 141, a gray scale or full color image coding unit 142, a transmission control unit 15, a transmission line 16, a display unit 17 for scaling down and displaying read data, an input pen 18 for inputting the position on the display, a processing unit 19 for extracting a character, etc. in a color area, a memory unit 20 for storing a discriminated image, a memory unit 201 for storing a characteristic, and a memory unit 202 for storing a gray scale or color image. A filling unit 21 fills a character portion of a gray scale or color image with the surrounding image data. "P" indicates an original.

The operations according to the embodiment shown in Figure 1 are explained below by referring to Figures 2 to 4.

Figure 2 is an explanatory view showing the procedure of discriminating between a character and a color image in a document in which characters and color images coexist. Numerals (1) to (6) indicate step numbers.

Assume that there is an original color document in which a color image is included in a part of a character area as shown in step (1) shown in Figure 2, and there is a character string formed by characters expressed by "characters" on the color image. There

are a number of documents in this configuration in color image magazines, etc., and it is predicted that there are a number of such documents to be electrically transmitted. These documents are read with relatively high resolution of 400 dpi, etc. by the original read unit 11, and temporarily stored in the memory unit 12. The information is transmitted to the area identification and discrimination unit 13, and the character document area (step (2) shown in Figure 2) is discriminated from the color image area (step (3) shown in Figure 2) and segmented (details of the discrimination are described later). In the character document area, the portion (encompassed by dotted lines) segmented as the color image area is filled with white information, and the entire data is processed by the MMR, etc. to enhance the coding efficiency. Furthermore, the characters, etc. are extracted from the color image area by the processing unit 19, and stored in the memory unit 20. The filling unit 21 fills the portion of the characters in the color image data (step (5) shown in Figure 2) accumulated in the gray scale or color image memory unit 202 with the surrounding average image data by referring to the character data (step (4) shown in Figure 2) accumulated in the document memory unit 201 so that a large density change cannot be made. In this color image data (step (6) shown in Figure 2), the high resolution such as 400

dpi, etc. is not required. Accordingly, a 1/2 scale-down process is performed to reduce the amount of information, and the resultant data is passed to the coding unit 14. The coding unit 14 uses various coding methods, for example, the MMR on a character document area, characters extracted from a color image area, etc., and the ADCT on a color image, etc., thereby separating it to character portions and grayscale portions and further reducing the amount of information. The transmission control unit 15 adds a header as shown in Figure 4 to the above-mentioned coded information, structures the information, and transmits it to a destination terminal through the transmission line 16. The header shown in Figure 4 shows that the characters of block 3 are red. Figure 3 shows the flow of the processes. Figure 3 is associated with Figure 2.

As described above, since data is divided based on the area and attribute, and then transmitted, an efficient coding method in each case can be used. Especially, although the ADCT is a very efficient coding method for a color gray scale image, its coding efficiency is low for an image having many edges such as a character image, etc., and the quality of a transmitted image is not so good. On the other hand, the MMR is high in coding efficiency for a character image, and can output one pixel at about 1/20 bit, but has the disadvantage that a gray scale image cannot be

encoded. The present invention excels in coding various types of data. The problem in realizing the present invention is to determine how efficiently, easily, and quickly discriminating between the character document area and the color image area, and extracting characters, etc.

Methods of automatically identifying a color image area are listed below.

(1) Method of identifying an area as a partial area such as 4 × 4, etc. by frequency of density change frequency and density distribution.

(2) Method of checking the unbalance of density distribution for each color, and assigning a portion indicating a large density change in monochrome or single color as a character portion.

(3) Method of identifying data based on a difference in sequence of pixels among characters, line drawings, and dot meshing images.

The above-mentioned methods can be used in combination.

Furthermore, the following method of manually specifying an area can be used.

For example, with the appearance as shown in Figure 5, an original read system is structured. Other than a housing 21 of an original read system, the reference numerals shown in Figure 1 are also used here. In this read system, a once read image is scaled down

and displayed on the display unit 17, a discriminated area is set by the input pen 18, and discriminated by the area identification and discrimination unit 13 based on the coordinates. The display screen is scaled up and displayed for an easy discriminating process, and settings can be performed on the screen. Thus, when manual settings can be performed, the discrimination can be realized with high accuracy although an automatic process cannot be successfully performed. Furthermore, if the automatic process is performed on an area after performing manually and roughly settings on the area, the area for the discriminating process is limited, thereby enhancing the process accuracy and semi-automatically performing the process with high accuracy. The discrimination position can be set by a cursor, etc., not using the input pen 18.

A method of extracting a character, etc. in a color image area can be a method of extracting it based on a distance in a color space. Since a character in a color image area cannot be easily read if it cannot be easily identified in an image by a person, it can be detected in the method of determining at the distance in the color space based on the concept similar to the binarization in a normal monochrome image. If it cannot be detected, it means there is not a large difference from the background. Therefore, the

increase in the amount of coding is not so large when the data is coded as a color image. Thus, characters, etc. are extracted and accumulated in the document memory unit 201. Since there are characters remaining in the color image in the gray scale or color image memory unit 202, the portion has to be filled with surrounding and average image information. The filling unit 21 replaces the edge pixels of characters with the average values of the vicinal color images, and performs a replacing process by linear interpolation such that the internal pixels can smoothly continue to the replaced edge pixels on the other end. Thus, a color image from which characters have been removed and a character image are generated, and are transmitted to the coding unit 14.

Figure 6 shows another embodiment of the present invention. The embodiment shown in Figure 1 refers to a color screen overlapping a character screen, while the embodiment shown in Figure 6 refers to characters not overlapping the color screen. Therefore, the process according to the embodiment shown in Figure 6 is easier. Figures 7 to 10 are explanatory views showing the invention. Figure 6 shows the original read unit 11, the memory unit 12 for temporarily storing a read image, the area identification and discrimination unit 13 for identifying and discriminating a color area in the original, the coding

unit 14, the binary image coding unit 141, the gray scale or full color image coding unit 142, the transmission control unit 15, the transmission line 16, the display unit 17 for reducing the read data; and the input pen 18 for inputting the position on the display. They are equal to those shown in Figure 1.

The related operations are described below.

First, assume that there is a color document original including a color image in a part of the monochrome character area as shown in Figure 7. There are a number of documents in this configuration in color image magazines, etc., and it is predicted that there are a number of such documents to be electrically transmitted. These documents are read with relatively high resolution of 400 dpi, etc. by the original read unit 11, and temporarily stored in the memory unit 12. The information is transmitted to the area identification and discrimination unit 13, and the monochrome character document area shown in Figure 8 is discriminated from the color image area and segmented. If the segmented image is a monochrome color image, the segmented image is filled with white information from which a color image is segmented, and the entire data is processed by the MMR, etc. to enhance the coding efficiency. In this color image data, the high resolution such as 400 dpi, etc. is not required. Accordingly, a 1/2 scale-down process is performed to

reduce the amount of information, and the resultant data is passed to the coding unit 14. The coding unit 14 uses various coding methods, for example, the MMR on a monochrome image, and the ADCT on a color image, etc., thereby further reducing the amount of information. The transmission control unit adds a header as shown in Figure 10 to the above-mentioned coded information, structures the information, and transmits it to a destination terminal through the transmission line 16. Figure 9 shows the flow of the processes.

Figure 11 shows an example of adding a header according to another embodiment of the invention. In this example, not only a color image, but also a color character is included. Figure 12 is an original screen, and a part of monochrome characters includes red characters, and is provided with a color image. Figure 13 shows a screen in which each area is discriminated. The discrimination is performed by discriminating a color image portion in the method as in the above-mentioned embodiment, and the portion is segmented. Relating to the character portion, a red character portion is detected by the level difference between a red signal and a green signal, and the character portion is generated by segmenting the red character portion and filling the portion on the black character screen. The character portion is processed with the resolution of 400 dpi so that small characters can be

correctly read. A color image is scaled down as in the first embodiment, and coded by the ADCT. Since the red character screen is smaller than the monochrome character screen, there is the advantage of high coding efficiency in the MMR system. In the configuration of the header portion, the monochrome character screen is not transparent, the red character screen is transparent, and the color screen is not transparent. However, it is also possible to make a transparent color screen, and have an inking effect on the color image using the monochrome character screen. It is also possible to make a transparent monochrome screen, superpose the color screen on the background white screen, further superpose the monochrome character screen to have the inking effect, and superpose again the red character screen.

Figure 14 shows the amounts of coding and results of total evaluation on the two above-mentioned examples according to the present invention, the total ADCT system, and the total MMR system. In the total evaluation, × indicates "inapplicable", Δ indicates "not good", ; indicates "good", and T indicates "excellent". The original to be processed is a color photo of 10 cm × 8 cm inserted into the CCITT test document No. 4.

In the description above, the color image (especially a gray scale color image) is processed and

explained, but the method of discriminating and coding data containing only monochrome characters, color characters, etc. can be applied, which has the advantage of higher compression efficiency than the method of applying color coding on the entire data.

[Effect of the Invention]

As described above, according to the present invention, a character portion and a line drawing portion are detected from a color image in which images such as a full color image, a gray scale image, etc., and white, black, and color characters and line drawings coexist; portions only including characters and line drawings are discriminated; character and line drawing portions extracted in the discriminating process on the image in which characters and line drawings exist on a full color image are replaced with surrounding and average image values; thus images are generated by removing characters; and a coding process is performed on these images. Accordingly, since a color image area can be discriminated from a character area such as a monochrome character area, etc., and can be coded and transmitted, high efficiency transmission can be realized, and the quality can be further enhanced depending on the transmission method.

4. Brief Description of the Drawings

Figure 1 is a block diagram of the device for explanation of an embodiment of the present invention; Figure 2 is an explanatory view showing the procedure of discriminating a character from a color image; Figure 3 is a flowchart corresponding to Figure 2; Figure 4 shows a header; Figure 5 shows the appearance of an example of an original read system; Figure 6 is a block diagram of the device for explanation of another embodiment of the present invention; Figure 7 shows an image to be processed; Figure 8 shows the state of discriminating the image shown in Figure 7 between a monochrome character document area and a color image area; Figure 9 is a flowchart for explanation of the process; Figure 10 shows an example of adding a header; Figure 11 shows another example of adding a header according to another embodiment of the present invention; Figure 12 shows an image to be processed; Figure 13 shows the state of discriminating the image shown in Figure 12 between a monochrome character screen, a red character screen, and a color image area; and Figure 14 shows the comparison of an amount of coding, an electrical transmission time, the quality, the total evaluation obtained by the systems of the present invention, the total MMR system, and the total ADCT process.

The drawings show the original read unit 11, the memory unit 12, the area identification and

discrimination unit 13, the coding unit 14, the transmission control unit 15, the transmission line 16, the display unit 17, the input pen 18, the processing unit 19, the memory unit 20, and the filling unit 21.

5

Figure 1

12 MEMORY UNIT

13 AREA IDENTIFICATION AND DISCRIMINATION UNIT

19 PROCESSING UNIT

201 DOCUMENT MEMORY UNIT

202 GRAY SCALE OR COLOR IMAGE MEMORY UNIT

21 FILLING UNIT

142 GRAY SCALE OR FULL COLOR IMAGE CODING UNIT

141 BINARY IMAGE CODING UNIT

15 TRANSMISSION CONTROL UNIT

11 ORIGINAL READ UNIT

14 CODING UNIT

16 TRANSMISSION LINE

17 DISPLAY UNIT

18 INPUT PEN

20 MEMORY UNIT

Figure 2

#1 CHARACTER DOCUMENT

CHARACTER

#2 DISCRIMINATE COLOR AREA

#3 CHARACTER DOCUMENT AREA

#4 COLOR IMAGE AREA

#5 CHARACTER DOCUMENT

#6 CHARACTER

#7 EXTRACT CHARACTERS

#8 CHARACTER

#9 COLOR IMAGE

#10 FILL WITH CHARACTERS

#11 SCALE DOWN AND PERFORM ADCT

Figure 3

#1 DETECT OR SPECIFY COLOR AREA

#2 SEGMENT COLOR AREA

#3 CHARACTER DOCUMENT AREA

#4 FILL SEGMENTED PORTION WITH SURROUNDING INFORMATION

#5 EXTRACT CHARACTERS

#6 COLOR IMAGE AREA

#7 CHARACTER

#8 FILL CHARACTERS

#9 COLOR IMAGE

#10 SCALE-DOWN PROCESS, ETC.

#11 CODING BY ADCT

#12 CODING BY MMR

#13 TRANSMIT

#14 DESTINATION TERMINAL

Figure 4

#1 STARTING POINT

SIZE (A4, PORTRAIT)

MONOCHROME

NOT TRANSPARENT

CODING

#2 STARTING POINT

SIZE

FULL COLOR

NOT TRANSPARENT

CODING

#3 STARTING POINT

SIZE

RED

TRANSPARENT

CODING

Figure 6

12 MEMORY UNIT

13 AREA IDENTIFICATION AND DISCRIMINATION UNIT

141 BINARY IMAGE CODING UNIT

142 GRAY SCALE OR FULL COLOR IMAGE CODING UNIT

15 TRANSMISSION CONTROL UNIT

Figure 7

#1 CHARACTER DOCUMENT

#2 COLOR

Figure 8

#1 CHARACTER DOCUMENT

#2 COLOR

Figure 9

#1 DETECT OR SPECIFY COLOR AREA

#2 SEGMENT COLOR AREA

#3 FILL SEGMENTED PORTION WITH SURROUNDING INFORMATION

#4 CODING BY MMR

#5 SCALE-DOWN PROCESS, ETC.

#6 CODING BY ADCT

#7 TRANSMIT

#8 DESTINATION TERMINAL

Figure 10

#1 STARTING POINT
SIZE (A4, PORTRAIT)
MONOCHROME
NOT TRANSPARENT
CODING

#2 STARTING POINT
SIZE
FULL COLOR
NOT TRANSPARENT
CODING

Figure 11

#1 STARTING POINT
SIZE (A4, PORTRAIT)
MONOCHROME
NOT TRANSPARENT

CODING

#2 STARTING POINT

SIZE

RED

TRANSPARENT

CODING

#3 STARTING POINT

SIZE

FULL COLOR

NOT TRANSPARENT

CODING

Figure 12

#1 ORIGINAL SCREEN

#2 CHARACTER DOCUMENT

#3 COLOR

Figure 13

#1 MONOCHROME CHARACTER SCREEN

#2 CHARACTER DOCUMENT

#3 COLOR

#4 RED CHARACTER SCREEN

Figure 14

#1 SYSTEM

#2 CODING METHOD

CHARACTER PORTION

IMAGE PORTION

#3 AMOUNT OF CODING

#4 ELECTRICAL TRANSMISSION TIME

#5 QUALITY

#6 TOTAL EVALUATION

#7 SYSTEM ACCORDING TO PRESENT INVENTION

#8 PIXEL

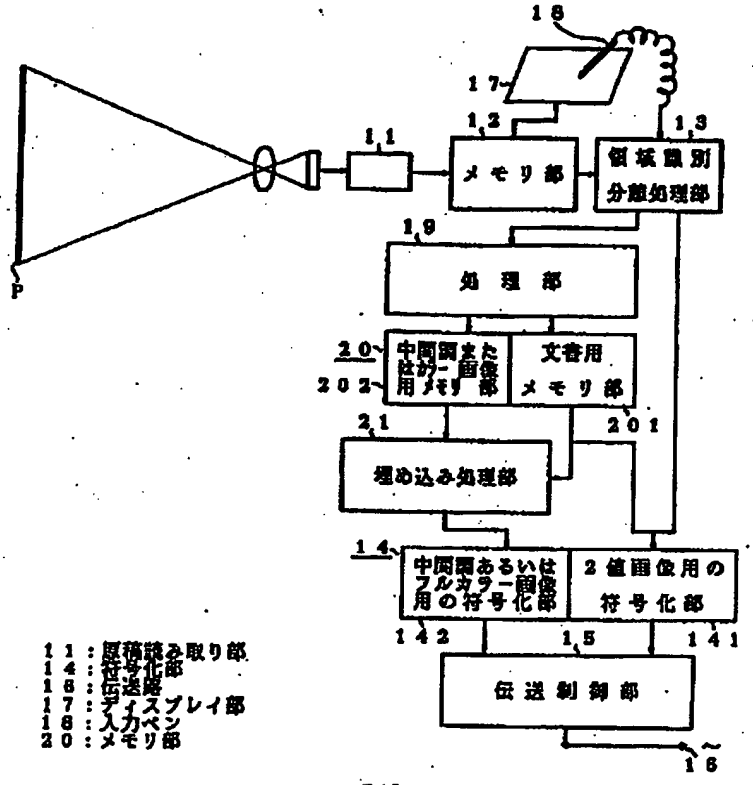
#9 TOTAL ADCT

#10 TOTAL MMR

#11 ORIGINAL

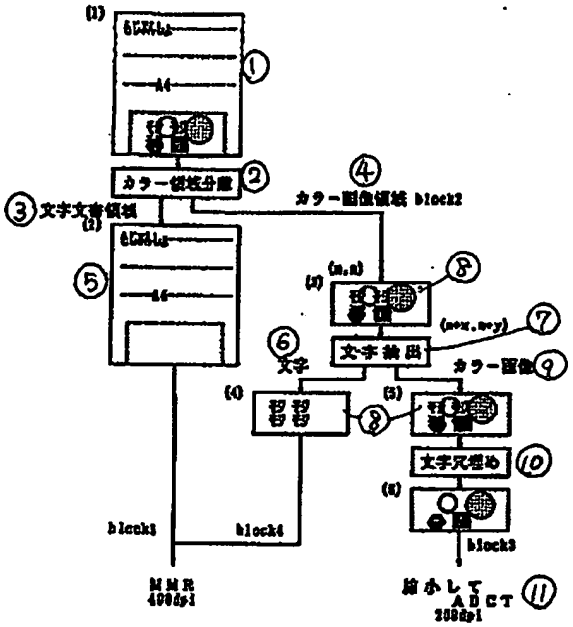
#12 INSERT COLOR PHOTO OF 10 CM × 8 CM INTO CCITT TEST DOCUMENT NO. 4

Fig.1 第 1 図

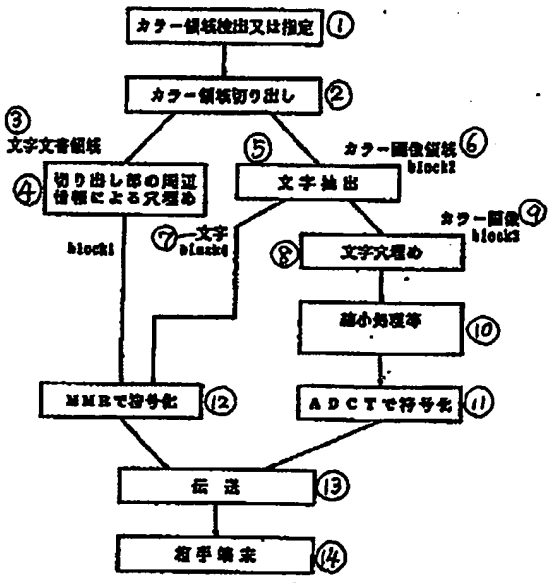


11：原稿読み取り部
14：符号化部
15：伝送路
17：ディスプレイ部
18：入力ペン
20：メモリ部

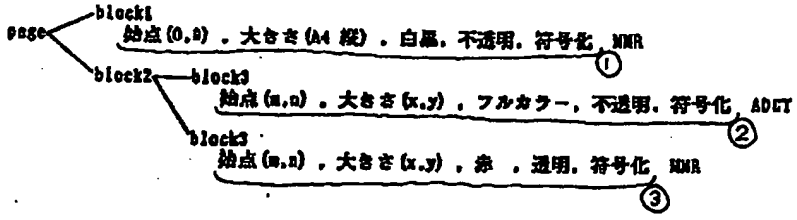
第 2 図 FIG.2



第 3 図 FIG.3



第 4 図 FIG.4



第 5 図 FIG.5